NonLinear Units Conversion
Local application
Fri, May 28, 1993

Radiation monitors called "scarecrows" and "chipmunks" are used to measure radiation in beam enclosures at Fermilab. The readouts are non-linearly related to radiation units of mr/hour. This note describes an easy implementation for support of the linearization of such signals, in order to make it easy for arbitrary host platforms to scale to engineering units linearly.

An example of the setup of this RADC local application is as follows:

```
E LOC APPL PARAMS 05/28/93 1036
NODE<0576>  NTRY<11>
NAME=RADC    CNTR=00AE
TITL"RAD MONITOR CONVERSION  "
SVAR=0004942C
ENABLE  B<00BE> RADC ENABLE
FORMULA1 <0001>
INPUT1  C<0000> N576T0      V
OUTPUT1 C<000B> RADT1       MRH
FORMULA2 <0002>
INPUT2  C<0000> N576T0      V
OUTPUT2 C<000C> RADT2       MRH
FORMULA3 <0000>
INPUT3  C<0000> N576T0      V
OUTPUT3 C<0000> N576T0      V
```

Up to three conversions can be specified in each instance of this local application. Each specification includes the formula index#, the raw channel#, and the result channel#. The formula index#s are 1 for chipmunks and 2 for scarecrows. The input channel provides the raw voltage reading. The output channel is a dummy channel whose scale factors have been suitably chosen to fit the expected range of the result and the resolution needed. Ultimately, it becomes a 16-bit signed value.

The operation of the logic is to get the reading of the input channel, apply the indicated formula, and write the result to the output channel using engineering units. The formulas used are of this form:

```
radiation:= Exp(c0 + v*(c1 + v*(c2 + v*(c3 + v*c4))))
```

The two cases supported simply use different coefficient values. Additional formulae could of course be added. This local application isn't restricted to radiation conversion. Any constants and coefficients needed would be part of the program code, however.

The source code is 183 lines of Pascal, executing in less than 1K bytes.